BOULDER TV Repeater's REPEATER

January, 2019

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REPEATER STATUS: On 20th of December, Don, N0YE, made a trip to the repeater site and installed his new Ch. 60, band-pass filter (filter details later in this newsletter). It was first tested operationally on that afternoon's ATV net. It seemed to help with 70cm reception. We only saw some RFI crawling thru Joe's, AD0I, analog TV signal. All of the 70cm DVB-T transmissions came through fine. We still have severe RFI on 70cm, analog TV from the BARC 2m repeater. But that is to be expected. That repeater is co-located with the TV repeater and shares the same tower. More work will be needed to reduce it's effect.

Discussions about the 146.70 RFI at a recent Friday morning ham breakfast suggested using instead the 146.76 repeater on Gunbarrel Hill. Historically, we have been associated with BARC and used their 2 meter repeater for our net voice intercom. However, this was started many years ago when our TV repeater was located in Chautauqua Park. No 146.70 RFI was experienced then because the repeaters were separated by about 2 miles. Now the antenna separation is measured in feet instead of miles. Debbie, WB2DVT, offered to ask the owner of the 146.76 repeater for permission to let the ATV group hold their weekly net on that repeater. Stay tuned for further details.

Details about the repeater are available on our web site: www.kh6htv.com AN-43 gives all the technical details. If you have any questions about the current operations or status of the repeater, contact the asst. trustee, Don, N0YE.

Future Newsletters: If you have contributions for future newsletters, please send them to me. Jim Andrews, KH6HTV, email = kh6htv@arrl.net

TV RFI: Since the TV repeater was moved to it's new location at a higher elevation, it has been more susceptible to RFI to it's 70cm receiver. Let's put some numbers on what rf levels are required for RFI. Back in 2014, I did some bench, lab measurements on co-channel and adjacent channel RFI to both analog (i.e. NTSC VUSB-TV) and digital (DVB-T) TV transmissions. The work was fully documented in my app. note, AN-19, which is available at www.kh6htv.com I will summarize the results relevant to our having RFI from FM voice signals here.

1. For VUSB-TV: Moderate RFI occurred at -25dBc (i.e. 25dB below the level of the video carrier) for CW/FM signals inside the 6 MHz channel. Outside the channel bandwidth the receiver rejected well interfering CW/FM signals. An interfering signal ± 6MHz from the video carrier needed to be greater than + 45dBc.

2. For DVB-T: For interfering CW/FM signals within the DVB-T pass-band that are >20dB stronger than the desired signal, the receiver will stop decoding the picture. Worst case is for an interfering CW/FM signal that is >17dB stronger on the center frequency carrier. For interfering CW/FM signals that are at least 4 MHz away from the DVB-T center frequency, they must be >45dB stronger than the desired signal to cause the receiver to stop decoding.

From these results, we see for in-band RFI, digital DVB-T is 45dB more tolerant of RFI compared to analog VUSB-TV. For adjacent channel RFI, both systems are about equal at +45dB.

You might also find it of interest as to what interference two DVB-T transmitters will cause to each other. The test was run with typical amateur DVB-T transmitters in which the spectrum regrowth, out of channel, breakpoints were at -30dB.

1. Signal strengths exceeding 30dB difference on adjacent channels will block reception on the weaker signal.

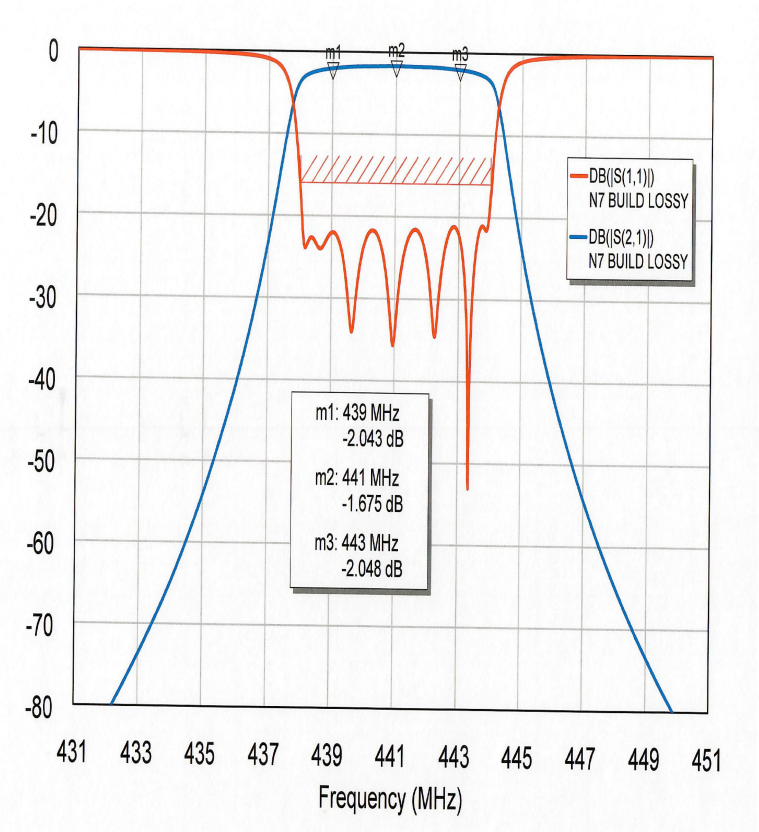
2. Signal strengths exceeding 50dB difference on channels separated by at least one empty, guard channel will block reception on the weaker signal.

3. Co-Channel RFI - No picture was received whenever the signal strengths from both transmitters were within ± 6dB of each other. Which ever transmitter's signal strength was +8dB stronger than the other one would capture the DVB-T receiver and give a perfect P5 picture.

WB9AIA / N0YE, Channel 60 (441MHz), 7 pole, inter-digital Band Pass Filter
Shown with the top cover removed.

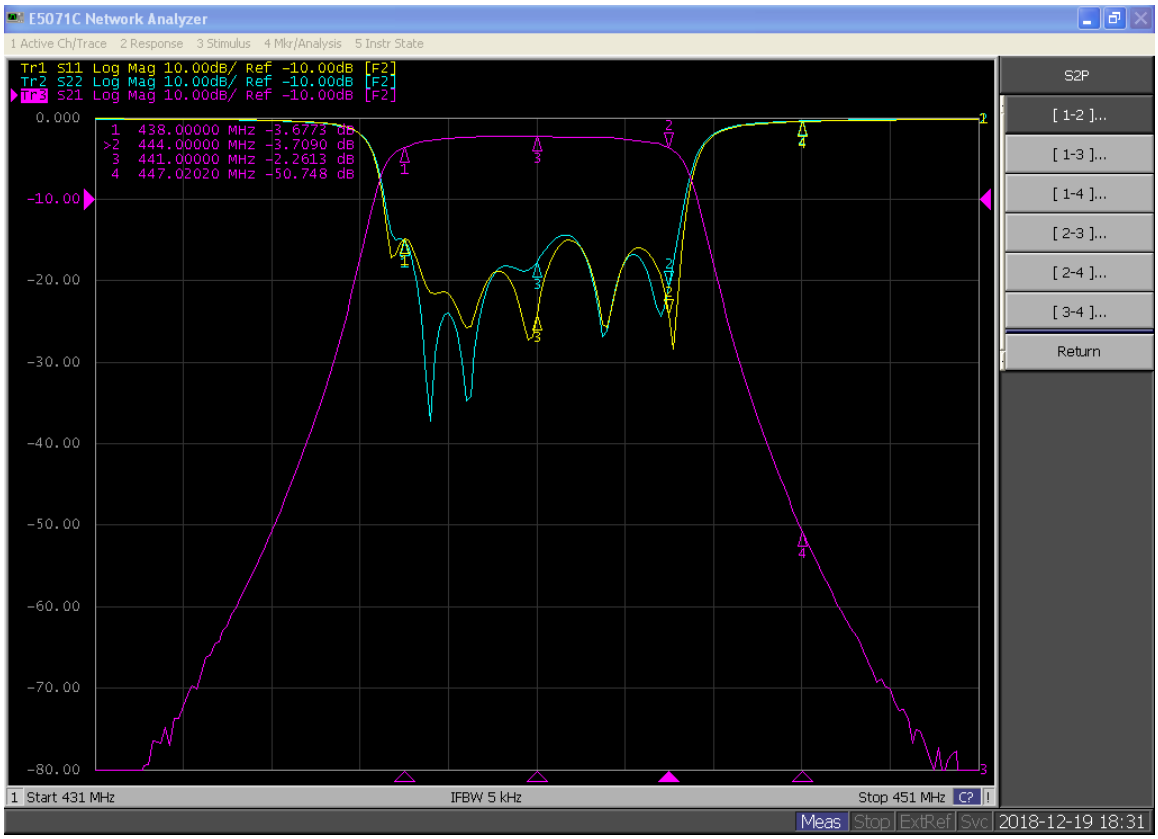
NEW 70cm BPF for Repeater: Because the repeater, from it's new location, has a lot more RFI on it's 70cm, Ch. 60 input, Don, N0YE, decided to build a new band pass filter (BPF) for it's receiver. The previous filter was an old Spectrum International, 5 pole, inter-digital BPF. It had been in service, since the mid 90s when the repeater was at Chatuatuqa Park. Spectrum studies showed that we were getting really strong signals from other amateur 70cm, FM voice repeaters in the 445-450 range, from up and down the Front Range. There were some especially strong signals around 447 MHz. The old filter was giving about -25dB rejection of the 447 signals.

Don decided we needed more poles in the BPF to give greater out of channel rejection. He turned to our resident filter guru, Dan, WB9AIA, (www.dgsboulder.com) for a design of a 7 pole, 6 MHz bandwidth, 441 MHz, band pass filter. This was discussed in the previous December newsletter. Dan has refined the design since then and given Don the mechanical drawing with precise dimensions down to 0.001" resolution. Don has now built the filter in his home workshop. The photo above is the finished product with the top cover removed to show the seven, 1/4" dia. resonator rods arranged in inter-digital fashion. The input and output coax connectors are BNC and are connected directly to the first and last resonator rod at the 50 Ω tap point. The overall inside dimensions of the filter are: 6.69" x 11.092" x 1.00" There are 8-32 tuning screws facing the open circuit end of each resonator rod. There are also 8-32 tuning screws in the top cover to control the coupling between each resonator. The following plot is the predicted response of the filter, including loss. At the center frequency, S21 = 1.7dB. S11 is better than -20dB across the pass band. At 447 MHz, S21 is predicted to be -55dB.



WB9AIA BPF predicted response for S21 and S11.

After Don built the new BPF, he tuned it up on his own HP network analyzer. With each succeeding try, he was able to improve things but was unable to match Dan's predictions. Don then took the new filter to Dan's QTH for the final tweaks by the real expert. The next plot shows the end result. Don reported, "Here is the output of Dan's E5071C Agilent network analyzer. Note that he got the IL=2.2 dB. And the IL at 447 MHz is almost 51 dB. He spent a lot of time getting the S11 and S22 to have as close to the same pattern of dips as well as getting as many of the 7 dips present. The rational for this effort was to minimize the insertion loss because of not really good RL on each port." The input and output return losses, S11 & S22 were always better than -15dB. The insertion loss, S21, at the center frequency of 441MHz was -2.26dB and -3.7dB at the band edges of 438 & 444MHz. The response was flat across the pass band, with no ripple. On the critical upper stop band, S21 was -19dB at 445MHz, -51dB at 447MHz and -70dB at 449MHz. The lower stop band was symmetrical with the upper stop band.



WB9AIA / NOYE, Ch. 60, 7 pole BPF -- actual performance of S11 (yellow), S22 (cyan) & S21 (magenta) Vert = 10dB/div. Center Freq = 441MHz, Horiz = 2MHz/div.

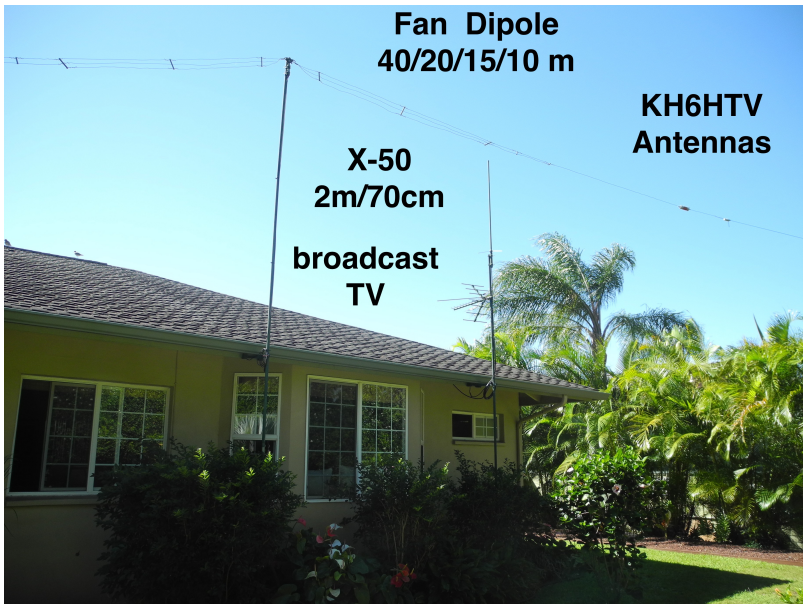
SLOW TV - MAUI STYLE: Ham TV activity on the island of Maui, in the Hawaiian Islands is island style, i.e. real slow. Fast-Scan TV (i.e. real live TV) on 70cm band is non-existent, unless you count my occasional transmissions to myself over a distance of perhaps 10 yards. In the past, I have also driven around the island with a TV receiver in my Miata convertible to see how far my signal would go. The farthest point was about 14 air miles. Over the past several years, I have given talks about ATV to our local Maui Amateur Radio Club (MARC), but to no avail. Have not gotten any recruits. The Maui club is small with typically about 15 members in attendance at club meetings. Their main interest is in HF. The closest I came to generating interest was a couple of years ago when MARC asked me to include a live ATV demo at their display booth for a STEM expo at our local shopping center, the Queen Ka'ahumanu Center in the main, port town of Kahului.

I did have some luck selling ATV, and in particular DTV with DVB-T, in Honolulu on the island of Oahu. In January, 2017, I made a trip to Honolulu, on the invitation of Joe Speroni, AH0A, the ARRL section manager for Hawaii and the Pacific. Joe asked me to give a talk about ATV, including a live demo, to the largest ham club on Oahu, the Emergency Amateur Radio Club, and also to the State of Hawaii Emergency Management people. They had had poor experiences with ATV (i.e. analog) in previous years and had given up on it. After my talks and demos, they decided to give DVB-T a

try. They asked me for a complete shopping list of stuff to purchase. I did sell them some rf linear power amplifiers and receivers. It took a lot of long distance hand holding via e-mail and phone calls to get them operational. They then did put their DVB-T gear to use successfully the following summer by televising a 4th of July parade. The most recent report from Clem, KH7HO, in Honolulu said "Unfortunately, ATV on Oahu is on hold right now. Hope to get it going again next year."

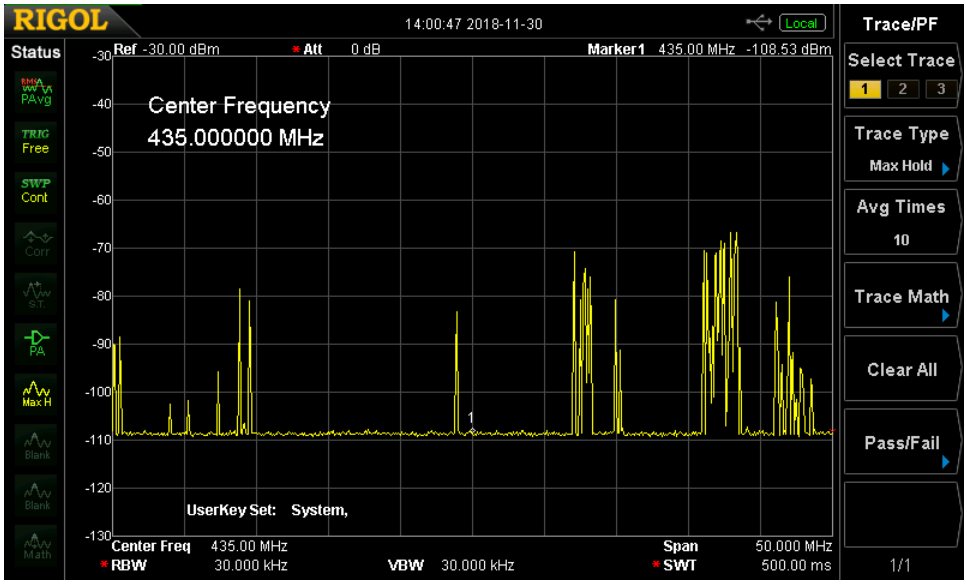
So my current ham TV activity is in the "Slow" mode, i.e. HF slow-scan, SSTV, on 20 meters (14.230 MHz). I have made a small number of SSTV contacts here. The photo above is a picture I received on 21st of November confirming a 2 way SSTV-QSO with W5BKV in Tulsa, Oklahoma. I do receive pictures here occasionally from North America and sometimes from Japan, New Zealand and Australia. The HF station here is less than optimal. Definitely doesn't compare with my Boulder HF station with it's Heath linear amp and 50ft. Hex beam antenna. Here I am using a 100 watt, Yaesu FT-857 feeding a 40/20/15/10 meter fan dipole up at only 23 ft. (run 40 watts on SSTV). The other antenna is a vertical. It is my old mobile antenna, a Yaesu ATAS-120 (40 thru 6m) planted in the back yard with 20 buried ground wire radials. My background HF noise level here is pretty bad on 20 meters. I rarely am able to make any contacts, other than an occasional FT-8. (Don't like FT-8, too automated and can't do a real QSO.) It is a BIG DEAL when I finally make a SSTV contact, or any HF contact really.

KH6HTV - Maui ham shack. 70cm ATV transmitter on top shelf. Middle shelf is ICOM 2m rig & 12Vdc power supply. Bottom shelf is Yaesu FT-857, 100 watt HF rig and MFJ antenna tuner. An antique Dell XP computer on the floor is dedicated to the FT-857.



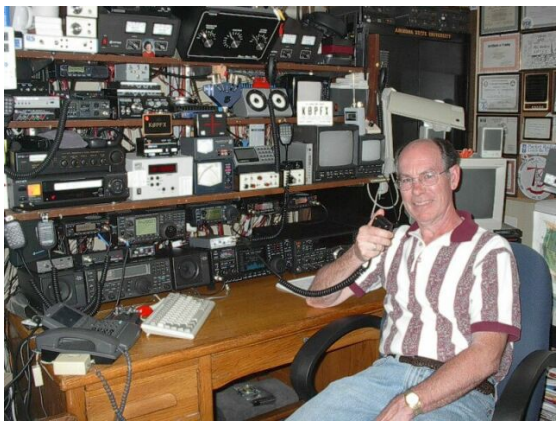
KH6HTV - Maui Antennas: For 2m/70cm, a Diamond X-50. For HF an Alpha-Delta Fan Dipole for 40/20/15/10 meters. Also a Yaesu ATAS-120, 40 thru 6m screwdriver mobile antenna with 20 ground radials.

KH6HTV VIDEO business also has been slow, real slow. There was a spurt of orders for amplifiers early in the fall. In addition to those orders, I actually built for stock a 70cm, model 70-7B and a 23cm, model 23-11A. They haven't sold and are still sitting on the shelf. Every time, I fly out to our winter home here in Hawaii, I always bring along some test equipment along with the raw materials to build amplifiers here. In years past, I have built and sold amplifiers from Hawaii in addition to from Boulder. So far, no orders. I look forward to getting some amplifier orders soon as it gives me something to do other than hang out at the beach and play tennis.

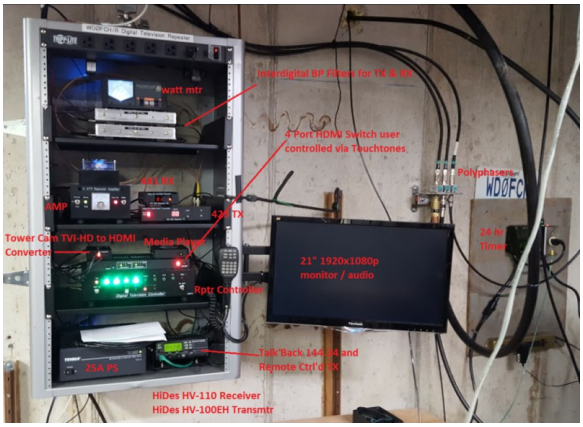


Maui 70cm Normal Band Activity --- 435 MHz center frequency, 50 MHz span, 5MHz/div. Data acquired in max. hold for 10 minutes

Maui 70cm Band Activity: In the November newsletter, I had some spectrum analyzer screen shots showing the level of activity in Boulder on both the 70cm & 23cm bands. (see pp. 3-5). I have repeated the same test here on Maui for the 70cm band. The spectrum analyzer was put in the Max. Hold mode for 10 minutes on a weekday around 2pm. There was a bit of 70cm ham FM repeater activity noted in the 440-445MHz range (repeater outputs) plus a signal at 434MHz. Otherwise, the amateur band was quiet. Here on Maui, the 70cm band is more popular for repeaters than 2 meters. The commercial band above 450 MHz shows activity. I don't have a 23cm antenna here to show that band's activity level.

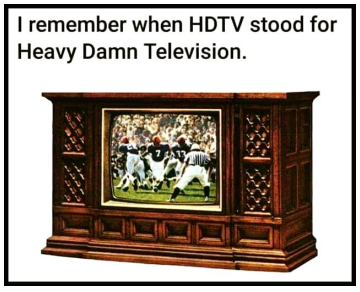


Mel, K0PFX



WD0FCH DVB-T Repeater

ATV/DTV in St. Louis: The hams in the St. Louis, MO area purchased a set of 70cm, interdigital, band-pass filters from Don, N0YE, and I to use in their new 70cm, DVB-T repeater. The head "Guru" there is Mel Whitten, K0PFX. Mel seems to be into all aspects of ham radio. I suggest you check out his personal web site: http://www.melwhitten.com/



Tnx 2 Ken, KV5Y

St. Mark's Anglican Church
"The Friendly Church"
WORSHIP SAT 5PM SUN 8:30AM & 10:30AM
ADAM & EVE
THE FIRST PEOPLE
TO NOT READ THE APPLE
TERMS & CONDITIONS

I've taken up photography because it's the only hobby where I can shoot people and cut their heads off without going to jail.

Tnx 2 CQ-DATV